INTEGRATED VEHICLE HEALTH MANAGEMENT (IVHM)

RESEARCH TEST AND INTEGRATION

(RTI)

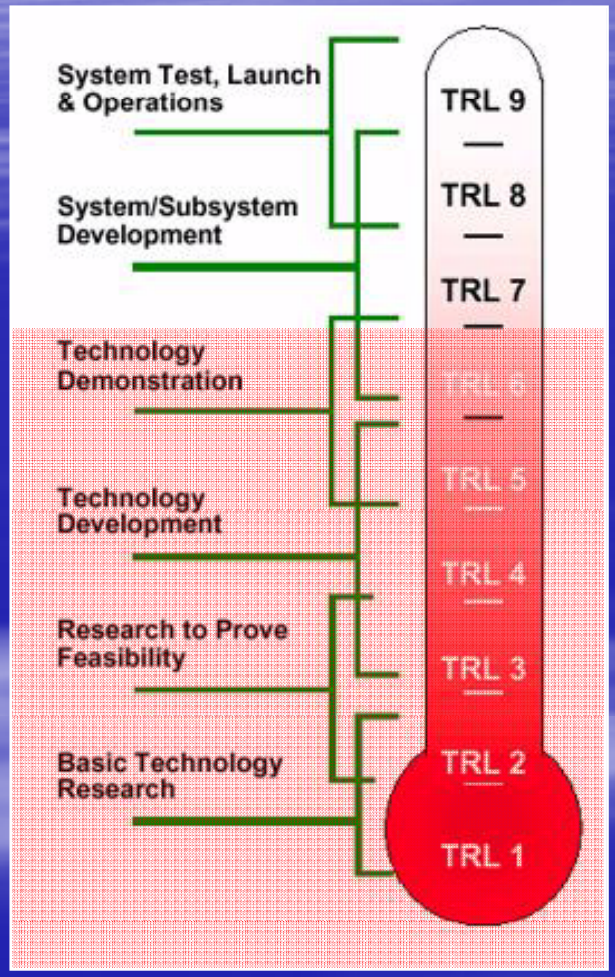
IVHM TEAM


Ontario
Maine
Montana
North Dakota
Minnesota
Oregon
Idaho
Michigan
Wisconsin
New York
South Dakota
Wyoming
N
Glenn
Pennsylvania
Iowa
Nebraska
Ohio
Nevada
Utah
Illinois
Indiana
Langley
California
Colorado
Virginia
S
E
OGA
Industry
Academia
Ames
Kentucky
Dryden
North Carolina
Tennessee
Oklahoma
South Carolina
Arizona
New Mexico
Arkansas
S
Alabama
Georgia
Mississippi
Texas
Louisiana
Florida
Gulf of California

IVHM and RTI

- IVHM is an extensive multi-center program to develop validated tools, technologies and techniques across 5 themes:
  - Detection
  - Diagnosis
  - Prognosis
  - Mitigation
  - Integrity Assurance
- These themes will conduct research in four areas of the vehicle:
  - Airframe
  - Propulsion
  - Aircraft Systems
  - Software Systems
- RTI is a tool set to guide and implement the validation, integration and testing of these technologies and techniques. RTI consists of a Test and Integration Plan, a working group comprised of multifaceted/disciplinary members from industry, government, academia and NASA.

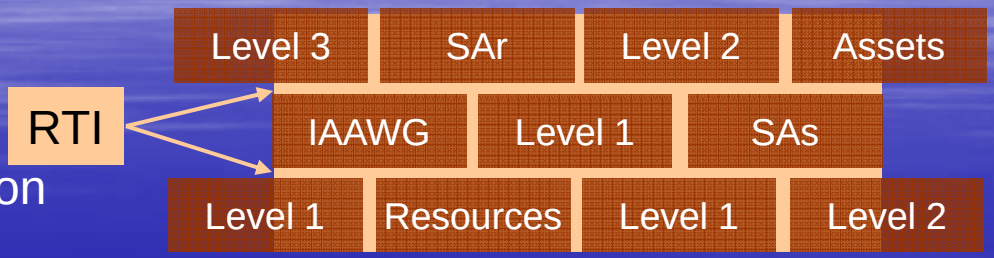
IVHM and Technology Readiness Level (TRL)

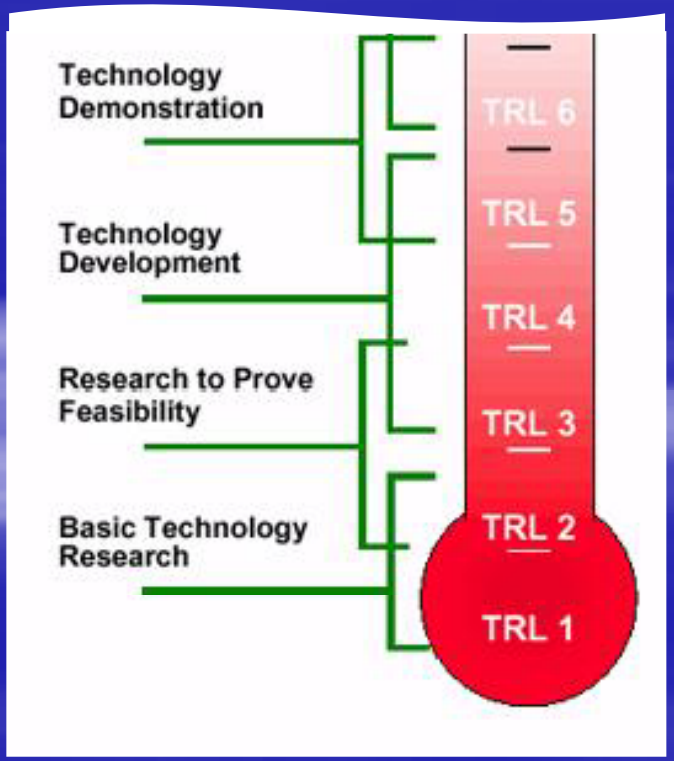


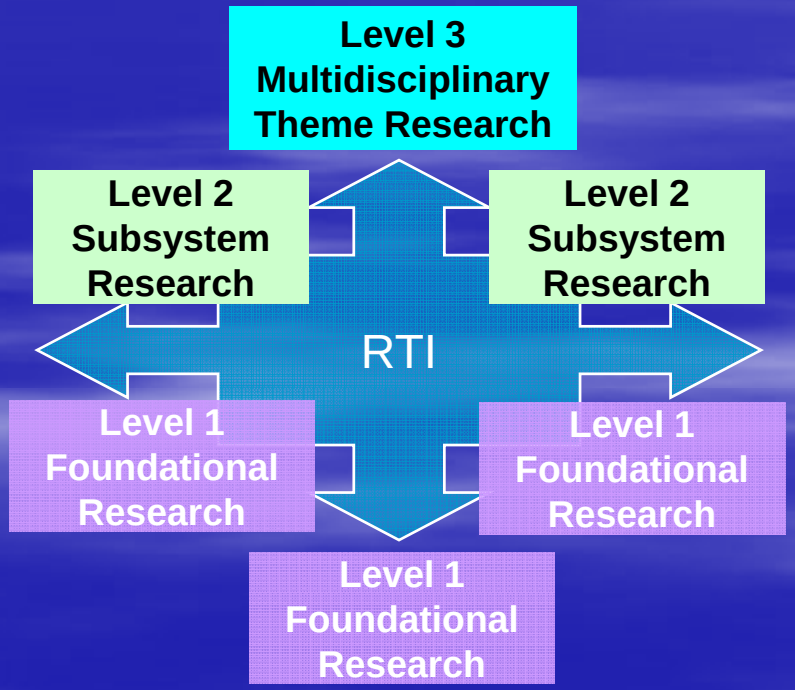
TRL 1: ***Basic principles observed and reported.***
TRL 2: ***Technology concept and/or application formulated.***
TRL 3: ***Analytical and experimental critical function and/or characteristic proof-of-concept achieved in a laboratory environment.***
TRL 4: ***Component and/or breadboard validated in a laboratory environment.***
TRL 5: ***Component and/or breadboard validated in a relevant environment.***
TRL 6: ***System/subsystem model or prototype demonstration in a relevant environment on the ground or in space.***
TRL 7: ***System prototype demonstrated in a space environment.***
TRL 8: ***Actual system completed and "flight qualified" through test and demonstrated on the ground or in space.***
TRL 9: ***Actual system "flight proven" through successful mission operations.***

What Is RTI?

RTI is the mortar that brings the bricks of Research and Technology together for Integration and Testing.







Tool 1 - Research Test and Integration Plan (RTIP)

- RTIP is a living adaptive document designed to aide and provide direction on how Test and Integration will be performed across the 5 theme levels previously identified.
- The document is similar to a Detailed Test Plan like what is used in the Flight Test community. The difference is that it is dynamic and will change accordingly throughout the IVHM program to meet changes in the aviation world, industry requirements, working group ideas and system analysis outputs.
- The tool is to be hosted in wiki architecture with leveled access.

Tool 1 - Research Test and Integration Plan (RTIP)

Chapter 1 Introduction - Programmatic

Chapter 2

- IA&AWG
- SA – Table 2

Chapter 3 Theme Level

- 3.1 Detection
- 3.2 Diagnosis
- 3.3 Prognosis
- 3.4 Mitigation
- 3.5 Integrity Assurance

SYSTEMS ARCHITECTURE FOR RTI

Chapter 4 - Resources and Assets

- Laboratory
- Test Fixture
- Ground Test
- Flight Test
- Other

Chapter 5 RTI Results Reporting - Accountability

Chapter 6 - Appendices, References, Notes and Applicable Documents

Tool 2 – Working Group

- As an input into the RTIP, a working group is being established encompassing as many areas of aviation as possible. Their Charter:

IA&AWG

Convene the Integration Architecture and Assessment Working group to review.

1. Assessment of at least two candidate IVHM System Architectures that would enablesystem level reasoning,

2. Development of requirements for a system level reasoner for health management technologies,

3. Assessment of techniques to manage and propagate uncertainty for diagnostics and prognostics and their impact of those techniques on system integration and architectures,

4. Assessment of asynchronous messaging and the development of standards for message passing for health management technologies,

5. Development and assessment of standards to address specific hardware and software integration issues.

6. Novel methods for testing and evaluating health management technologies,

7. Impact of IVHM architecture designs and approaches (distributed, centralized, hierarchical) on increasing safety,

8. Impact and potential value of large-scale sensor networks (wired, fiber optic, or wireless) in increasing safety

9. Value of self-healing and self-diagnostic avionics architectures (through redundancy, reconfiguration, or other means)

10. Assessment and cataloging of testbeds that that reside outside of the project and that could be used by the IVHM project. This information will be included in the Research Test and Integration Plan.

Tool 2 – Working Group

Research Test & Integration
Systems Analysis

Ames Research Center

GRC GLENN RESEARCH CENTER at Lewis Field

Commercial Industry

Other Government Agencies (tbd)

AIR FORCE RESEARCH LABORATORY

FEDERAL AVIATION ADMINISTRATION

NASA APIs

GRC GLENN RESEARCH CENTER at Lewis Field

Ames Research Center

NASA Langley Research Center

Tool 3 – Systems Analysis

- Review statistical data and literature from academia, industry, and OGA to interpret and extract information about causal factors in current aircraft safety incidents and accidents.

- Document reports by subject matter experts on future directions in IVHM related research areas.

- Assess future directions in aviation technology as related to IVHM research areas.

Bottom Line

- This is a big effort that is still in work and will continue to change as research is conducted!